HUMAN BIOLOGY
a record of research
DECEMBER, 1942
VOL. 14 No. 4

THE INTRODUCTION OF BLOOD-GROUP B INTO EUROPE

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THE progressive eastwardly rise in the proportions of group B in Europe is a matter of common knowledge, and the subject of frequent comment. Over ten years ago, Bernstein ('30) concluded that the source of Europe's group B is to be sought in Asia, and his opinion is shared by most writers, regardless of their views with respect to other blood-group questions. Boyd ('40) holds the special view that the former absence of group B in Europe was due to the fact that the early European populations had lost the B factor at some time in the past, through the operation of chance variations in small isolated ethnic groups.[1]

However, since there is no considerable disagreement with regard to the main premise, only one question remains to be answered, namely, *when* and *by whom* was the B factor introduced into Europe? It is now becoming evident that definitive answers to queries such as this one can never be forthcoming from the serological data alone, but must derive from a detailed consideration of the other disciplines as well.

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[1] Experimental evidence from the study of insects is said to support this premise. However, although purposeful, controlled experimentation may demonstrate that a given mechanism is theoretically possible, this is not to say that it must, or even could have been operative under uncontrolled conditions, involving the human or subhuman animal. If one should choose to accept a set of assumptions different from those chosen by Boyd, one would be equally justified in concluding that some branches of mankind have never possessed the blood group factor which they now lack.

The blood group factors are not esoteric abstractions, to be interpreted intuitively; they are concrete biochemical entities, present in the tissues and the blood of every human being, and they constitute a part of his genetic heritage. A complete understanding of these factors can be possible only from a consideration of all the various kinds of data which may be available regarding the populations whose blood groups are under consideration. And it is only when such a complete understanding is more closely approached that the blood groups may be expected, in their turn, to be of assistance to the other disciplines.

Since the problem under present consideration involves only one of the three inheritable blood group factors, and since the historical adnexa are reasonably complete, it offers a fair test of the method which it is proposed to adopt. This method consists of the combined use of the historical facts, the ethnic data, and the present distributions of the B factor in the relevant populations. As concerns the present argument, the outstanding historical fact is undoubtedly the occurrence of periodic mongoloid and mongol-white expansions from Asia into Europe, commencing in the 5th, and ending in the 15th centuries of the Christian era.[2]

Until recently, few anthropological or serological data were available regarding the peoples whose ancestors were involved in, or historically associated with, the events of that era. Within the last two decades, however, the efforts of the Russian anthropologists have shed much light upon the physical characters and the blood groups of the native tribes of European and Asiatic Russia (Vishnevsky, '36). In addition, much new data exists regarding the peoples of Hungary, Poland, and the other peoples of the contact zone.

During the past two years, the results of these researches have become available in English, and in compact form. The physical characters are summarized in Prof. Coon's book, *The Races of Europe* (Coon, '39), while the blood groups are tabulated in a comprehensive monograph by Prof. Boyd ('39).[3] As a result, it is now possible to attempt a detailed correlation between the physical and the serological characteristics of the descendants of the various elements involved in the Asiatic invasions of the Middle Ages.

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[2] The conquest of the Alans and the Ostrogoths in the 4th century by the Huns under Balamir is not relevant, for reasons which will appear.

The researches of Bartucz have removed all doubt that the Huns and the Avars of the invasions of the 5th and 6th centuries were true mongoloids. In fact, the studies made by Bartucz upon thousands of Avar cemeteries indicate two clearly differentiated monogloid types of crania, those of the Huns being dolichocranic, and those of the Avars brachycranic. The modern representatives of these two kinds of mongoloids are said to be the modern Tungus and the modern Buriat Mongols, respectively (Coon, *loc. cit.*, p. 231). Both types of crania were found in most of the graves, but the Avar type was more frequent, and in some graves only one of the two kinds was found. From the size and the numbers of the Avar cemeteries, Bartucz concludes that the Asiatic invaders played an important part in the peopling of Hungary and of the entire Danube basin (Coon, *loc. cit.*, p. 229 ff.).

During some ten centuries, the Don country of southern Russia seems to have served as a central depot for these peoples, and especially for the various Turkish-speaking tribes allied and related to them, who made up the greater bulk of the invading armies. Indeed, it was the latter who conducted the numerous campaigns into the Danube areas, into Asia Minor and North Africa, and even into Italy. The Magyar invasion of Hungary in the 9th century was carried out entirely by such 'Turks'.

In the 13th century, vast hordes of true mongoloids under the leadership of Genghis Khan again overran eastern Europe. They conquered Poland and Hungary, and reached the borders of Saxony. These armies are said to have incorporated most of the central Asiatic Turks, but in any case, their cranial type was the same as that of the purely mongoloid Kalmucks, who are a remnant of that invasion. and of the earlier Avars and their modern representatives, the Buriat Mongols (Coon, *loc. cit.*, p 235).

It is the considered opinion of this writer that group B was brought into Europe by the brachycephalic mongoloids and their followers during the ten centuries of intermittent invasion, conquest and occupation, and that before their arrival the B factor was almost absent from European populations. Objective proof of the validity of this conclusion could be afforded only by the performance of blood group tests upon documented skeletal material from the appropriate areas and the relevant time levels. Such studies can and should be performed in connection with all such problems,[4] but even in their absence, a strong case can be made out in this instance from the blood group distributions of the living populations, studied in conjunction with other data relating to them.

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[3] As a matter of convenience for the writer and the reader alike, almost all of the anthropological data and the blood group data have been taken from the works of Coon and Boyd, respectively.

In order to be acceptable, the evidence must involve five distinct categories of populations, and must fulfill the following requirements with regard to them:

(1) The modern descendants and representatives of the pure mongoloid invaders must be shown to have very high proportions of group B. These proportions must be higher than those present in any of the four other categories.

(2) The mixed (partly mongolized) populations whose ancestors accompanied, and for long periods superseded the Mongols along the path of invasion must be possessed of lesser, but still quite high proportions of group B.

(3) The European populations in the zone of contact, known to have borne the brunt of the invasions, and in consequence to have mixed with the invaders to some extent, must have considerably smaller amounts of group B than the Turks and Tatars who largely make up the 2nd category, but more than the peoples of the next class.

(4) Those people who were geographically remote from the scene of the invasions must have smaller amounts than any of the first three categories, having acquired the B factor chiefly through diffusion.

(5) The descendants of those populations which fled from the invaders, and have lived in comparative isolation until the present time, should be found to have the smallest proportions of group B of all, even less than those populations who were distant from the contact zone.

Fortunately, sufficient data now exists to make possible the almost complete fulfillment of all these requirements. In addition to listing all the available blood-group data from Europe and Asia, Boyd's invaluable tables perform the added service of distinguishing between the European Russians of Russia and Siberia, and the non-European peoples of the entire U.S.S.R. (Boyd, '39). In addition to the peoples of the Caucasus, who represent the refugees of the 5th Category, the non-European populations include for the most part the mongoloid and the mixed Altaic and Finno-Ugrian tribes, extending from the gates of Europe to the Buriat-Mongol Republic and the Far East Territory.

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[4] The reliability of blood group tests upon human bones was recently demonstrated by the use of material obtained through the courtesy of the Doctors Boyd (Candela, '40).

METHOD OF COMPARISON

Before this material can be utilized, it is necessary to decide upon a method of analysis upon which the comparisons shall be based. Since it is proposed to compare actual ethnic groups, occupying the same or overlapping territories, it is obvious that graphic methods such as the commonly used "contour lines of equal frequency" will be of no assistance. What is desired is an expression of the frequency of group B in each of the individual ethnic groups, and not in a general geographical ambient. For this reason, the five categories of peoples will be compared directly in terms of their actual frequencies of q, which represents the percentage frequency of the gene for group B.

The next question has to do with the choice of samples to be included or discarded. This matter is of some importance, and will require discussion, since it has contributed to the current confusion. Briefly, it may be said to stem from the genetic equation, which requires that the sum of the frequencies of the three blood-group genes, p, q, and r, shall be 1.000, or unity. When the sum of the gene frequencies deviates from unity, the importance of that deviation depends mathematically on the size of the sample, so that a larger deviation is "permitted" in a sample of 100 persons than in one of one thousand.

The various authors differ as to the relative size of the deviation which they will permit in an 'acceptable' series; thus, Boyd demands that the deviation shall be not more than twice the probable error, while Haldane ('41) rejects only those samples in which the deviation is more than three times the probable error. Further, there is no unanimity regarding the minimum size of an 'acceptable' series, some accepting samples as small as 100 persons, others requiring 200, while Haldane (*loc. cit.*) deals chiefly with groups of 2000 or more, and has pooled smaller series in order to obtain samples of sufficient size for his purposes. Thus it is to be noted that some samples are discounted because of insufficient size, and in spite of their small deviations, while others are discarded because of their large deviations, and in spite of their large size; furthermore, since individual standards differ as to both criteria, some samples will be included by one author, but rejected by another.

The consequences of these individual variations in the choice of material are easily foreseen. The inclusion or exclusion of one or another sample, for one reason or another, can produce marked variations in the resultant interpretations of the serological character of a population. Nor is it possible for an author to be entirely consistent in the application of his own set of rules, since in many areas and among many peoples there is a dearth of information of any kind, and consequently, 'unsatisfactory' material must be included, or the space left blank.

What is the intrinsic significance of these criteria? As regards the formula for the sum of the three gene frequencies, it is predicated on an ideal population, one which is completely stable and homogeneous, and in which there is completely random marriage. It is safe to say that such populations are almost non-existent. In primitive as well as in civilized communities, marriage choices are governed by conventions of varying rigidity. In the tribe, these take the forms of exogamy, endogamy, polygyny, cross-cousin marriage, the levirate, etc. In the higher communities, the conventions are concerned with marriage within the social stratum, the economic level, the religion, or the nationality group.

In addition to such differentials within a single ethnic group, there are those which exist between the differing groups and subgroups within a single national boundary. In many parts of eastern Europe it is common to find such ethnic subgroups living in social, if not physical isolation; it would be futile to expect that $p + q + r$ should total unity when two or more such subgroups are lumped together in the same series. The unacceptably large deviations from unity in many large samples must be due to such social and ethnic heterogeneity more frequently than to errors in technique.

In fact, it is probable that such heterogeneity may be much more common than the blood-group formulae indicate; it is quite possible that a large series having a small deviation may actually be a composite of two or more unrecognized series having deviations of opposite signs, which by cancelling each other, have imparted a false appearance of homogeneity to the final result.

This is not to minimize the importance of the gene formulae, which have contributed enormously to the understanding of blood-group problems, and without which, indeed, such studies as this one would not be possible. I desire merely to point out that such mathematical expressions are only tools, and are not an end in themselves. Statistical procedures have an important place in the analysis of all data, but they should not be permitted to become fetiches, and to obstruct the very efforts which they were designed to assist. Further, the scarcity and the unequal weight of some of the data makes it undesirable to lean too heavily upon mathematical analyses. In such instances, these become over-refinements, comparable to the calculation to six decimal places of the means of a very small number of anthropometric measurements.

Nor is it intended to discount the possibility or the importance of errors in technique. Not only do such errors occur, but it is not difficult to find in the literature even some errors in simple arithmetic. The essential point is that the mere presence of a large deviation does not in itself constitute proof of errors in technique, and that if a broad enough view is taken, the danger from such 'inconsistent' samples is less than the danger arising from an arbitrary choice of material.

As regards the small size of some samples, little need be said. One must often accept that which exists, or go without. However, such an acceptance need not always be reluctant, since in those countries from which a large number of samples are available, the gene frequencies of the small series usually fall within the range of the data as a whole. Sampling errors are undoubtedly present in many small series; however, it would appear better to accept that risk, rather than to level off the distinctive, and perhaps highly significant characteristics of a small sample by pooling it with another sample from which it differs radically.

For these reasons, I have decided not to exclude from consideration any of the series contained in Boyd's tables. It has appeared preferable to use the data as they were obtained and reported by the investigators, rather than to insist on homogeneity where perhaps none should be expected; I have used small series at their face values rather than to manufacture artificially large ones by pooling two or more small series.

Actually, since only one of the three genes is to be considered in these hundreds of series of European and Asiatic peoples, this method is more valid than might at first appear. The reported values of q are probably just as often too low as they are too high, and in the long run, the picture will be accurate. Better still, its validity is demonstrated by the fact that the results of the comparisons are so clear-cut that it is not likely that they could be disturbed by the application of any of the arbitrary standards in common use.

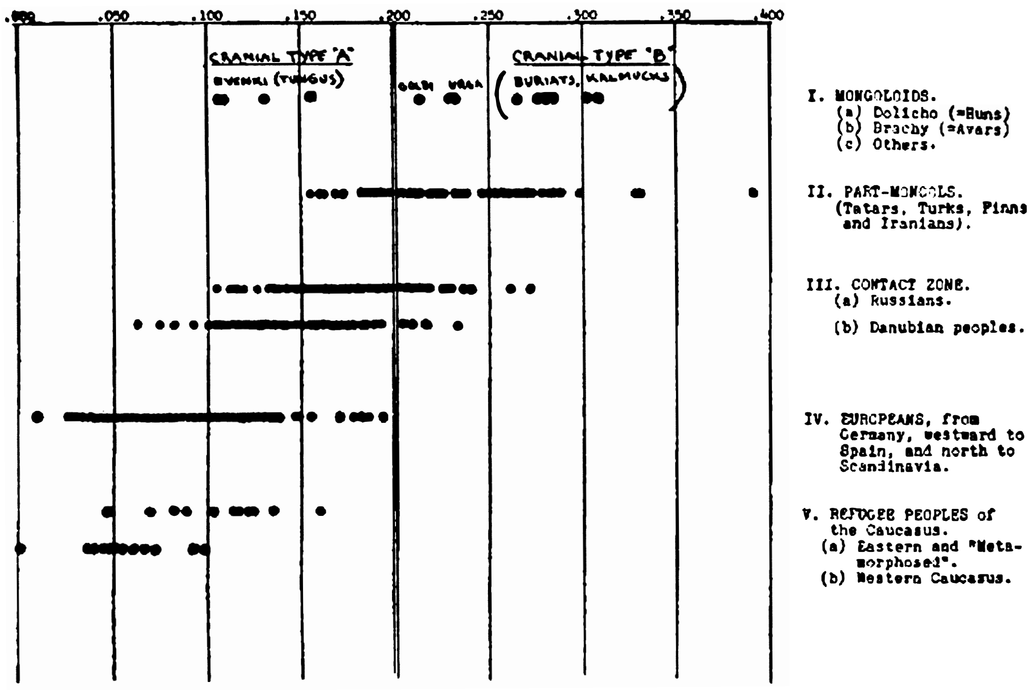

FIG. 1. THE VALUES OF q IN THE FIVE CATEGORIES OF POPULATIONS

COMPARISONS

Fig. 1 has resulted from the plotting of the q values of 749 series, according to their respective positions in the five categories. The number of series in each of the categories is as follows: 13 samples in the 1st Category, 84 in the 2nd, 292 in the two parts of the 3rd, 335 in the 4th, and 25 in the two parts of the 5th Category. Each value was plotted individually; where a number of samples have overlapped, a solid line has resulted. In three of the instances in which this has occurred, the line includes all but a very few samples; in the 2nd Category, however, the line is more disconnected, reflecting a concomitant ethnic heterogeneity (v.i.).

A *q* value of .200 has been adopted as a reference point, since this represents a higher frequency of the B-gene than is present in any of the 335 central and western European series of the 4th Category. The sharp progressive decline in the ranges of the values of *q* is strikingly illustrated by both the maximum and the minimum values in the successive categories, and even the rate of decline tends to be the same at both ends of the ranges.

Where solid lines have resulted from overlapping, these lines follow the same curve; thus in the 2nd Category, the (almost) solid line ranges between .180 and .270, since only 8 or 9 of the 84 samples exceed this maximum value. In the European Russians of the 3rd Category, the main cluster ranges from .130 to .220, while in the other peoples of the same category, it lies between .100 and about .180. In Germany and the more distant peoples of the 4th Category, the solid line extends from about .025 to .140 (see also Fig. 2).

It now remains to discuss the historical and ethnical data relevant to the populations in the five categories, and to see whether the requirements regarding them can be fulfilled.

Requirement No. 1 (pure mongoloids, very high in B). These fall into two main groups: those representing the dolichocephalic Huns, and those descended from, or representative of the brachycephalic Avars. According to the Russian authorities cited by Coon (*loc. cit.*, p. 231), the Hunnish cranial type is found in the modern Tungus and paleasiatics, and is identical with Neolithic crania from Lake Baikal. The blood-group data referable to this ethnic type is far from adequate; however, it is sufficient to indicate a trend toward very high proportions of group O, moderate amounts of group B, and very small amounts of group A.

The term "Tungus" has varying connotations, some linguistic, and others ethnical. Thus, Lopatin ('37) includes the Orochee among the Tungus, while noting some differences from the latter, and in fact, relates the Orochee more directly with the Manchu. Similarly, the Goldi have been classed as Tungus, on a linguistic basis. However, Vishnevsky ('36a) declares that both these tribes and some others should be considered to be Manchu, and that the name "Tungus" should properly be reserved for the Evenki, whose range extends from the Enesei River to the Pacific, and as far south as Lake Baikal.

Vishnevski (*loc. cit.*) has reported 224 Evenki from this large area, and in these, the percentage of B was 21 per cent, and the q value, .125. Of this total number of 224, Boyd's tables list three of the component series, totalling 145 persons, in whom the values of q vary from .106 to .154 (see footnote No. 6). Thus the Hun = Tungus type of Mongol might be expected to add some B to other populations, but not a great deal. In fact, it would be much more efficient in raising the proportions of group O.

Before proceeding to the second of the two relevant mongoloid types, certain other pure mongoloids of the U.S.S.R. must be considered. These consist of one series of Sungari Goldi, with a q value of .213, and two series of mongols from Urga, with values of .239 and .242 respectively. These three samples are not considered in connection with the main argument, since although Mongols, they are neither Tungus nor Buriats, and therefore are not historically related to the problem at hand. At the same time, it may be of interest to note that the Urga Mongols appear to occupy a position which is intermediate between the Tungus and the Buriats, both as to serology and as to head form. The cephalic indices of the Tungus and the Buriats are given by Bean ('34) as 78.7 and 93.1, respectively, while the series of Urga Mongol crania in the U.S. National Museum are said to have cranial indices averaging 81.4 in the males, and 82.4 in in the females (Cameron, '29).

The brachycephalic mongoloid cranial type found in the Avar graves is said to have been the more numerous of the two, and besides, it was the only cranial type brought in by the armies of Genghis Khan. It is typified by the more pure among the modern Buriats, and by the modern Kalmucks, although in the instance of the latter. the brachycephaly is somewhat less extreme, and the historical association with the later rather than the earlier of the pure mongoloid expansions into Europe.

Five samples of Buriats are listed, totalling 5312 tribesmen. In all five series, the proportions of group B are very high, ranging from 37.5 per cent to 40.8 per cent, and the gene frequencies from .264 to .301. Two of the series, however, are described as "western" and "Irkutsk" Buriats, respectively, while two others are not identified. The more characteristic, and presumably more pure of the Buriats are to be found in that part of the Buriat-Mongol Republic which lies east and south of Lake Baikal. For this reason, it may be permissible to attach more significance to that series of 1260 Buriats known to have been derived from the Aimak region of the eastern part of the Republic. In these eastern Buriats are to be found the highest proportions of B, the gene frequency being .301, and the actual percentage of group B, 40.8 per cent.

It is interesting to find that the other component of the brachycephalic mongoloid subgroup exhibits almost identical values, in spite of being separated from the Buriats by almost the entire path of invasion. In the Kalmucks west of the Caspian Sea, the gene frequency of group B is .307, representing an actual frequency of 40.6 per cent.

It should be noted that although the Buriats and the Kalmucks are the purest representatives of the brachycephalic mongoloid invaders, nevertheless they are not unmixed. The former exhibit regional variations in their physical characteristics, while the latter must, according to Coon (*loc. cit.*, p. 583), have mixed to some extent with the Russians and Tatars. This does not mean, however, that they could have acquired their B through admixture. The proportions of group B in the Buriat and Kalmuck tribes are the highest in all Asia,[5] and close to the highest in the world. Thus, admixture could only have *diminished* and could not have increased their group B, since, in the light of present knowledge, no Asiatic people could have contributed to such an increase. It appears likely, therefore, that these brachycephalic mongoloids of the U.S.S.R. may once have had even higher proportions of group B than they now possess; however, it is evident that even without this possibility, they fulfill the first requirement in a most satisfactory manner.

Requirements No. 2 (partly mongolized non-Europeans), and *No. 3 (Europeans of the contact zone.)* These are most conveniently considered together, by means of a direct comparison of the frequencies

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[5] No Asiatic population is as consistently high in B as are the Buriats. Outside of the U.S.S.R., and aside from the Ainu, there are only three samples in all Asia in which the q value is .300 or over. One of the 38 Chinese series, and two of the 39 series from India fall into the .300+ column. The Hindus and the Koreans are well represented in the next lower range; however, the Chinese, who are closest to the Mongol homeland, are relatively low in B, since 63 per cent of their series have q values of less than .200. In contrast, four of the Buriat samples fall between .250 and .299, while the fifth and most characteristic series occupies the .300+ column, together with the Kalmuck sample.

TABLE 1

Comparison of the range of values of q in the pure mongoloids of the U.S.S.R. (Category I.)

NAME	NUMBER OF SAMPLES	UNDER .200	.200-.249	.250-.299	.300 OR MORE
Representatives of Huns					
Tungus (Evenki)[*]	4	****	....	....	....
Representatives of Avars					
Buriats, S. & E. of Lake Baikal	1	....	....	....	*
Kalmucks	1	....	....	....	*
All other Buriats	4	....	....	****	....
Other Mongols					
Sungari-Goldi	1	....	*	....	....
Mongols, Urga	2	....	**	....	....

[*] Boyd's tables list three series, comprising 145 of Vishnevsky's 224 Evenki. The remaining 79 have a *q* value of .106, and have been rendered as a fourth series (Fig. 1).

of *q* in the two categories of populations. The contact zone included all of eastern Europe, as far as the borders of Saxony. However, since the proportions of B in Hungary, Poland and Bulgaria are somewhat lower than those of European Russians, it is perhaps desirable to limit the main discussion to Russia alone, since in that country, the two categories of peoples are in relatively closer association, and the differences between them consequently more significant. It will be recognized that this limitation is not prejudicial, but rather the reverse.

There are 145 samples of European Russians listed in the blood-group tables, including those living in Asiatic Russia, and 86 samples described as non-European. This latter figure does not include the peoples of the Caucasus, who will be considered in a separate category, in view of their character as refugee populations. We may now subtract the Kalmuck sample, and the one Buriat sample known to have been derived from the more characteristic Buriat area, since these two series have been chosen to represent the 'pure Mongols, high in B' of the 1st Category.

This leaves in the 2nd Category some 84 series of non-European Russians, including the various Turko-Mongols, Turkicized Finns, Finnish and Iranian peoples, and the remaining mongoloid groups. Since it is believed that the ultimate source of group B is to be sought in the Mongol and the strongly mongolized populations, it would be permissible to remove from this category the Finnish and Iranian tribes of the U.S.S.R., and to class them with the 'white' peoples of the 3rd Category, who are thought to have obtained their B from the mongoloids. However, since we have chosen to distinguish simply between 'European' and 'non-European' populations within Russia, these essentially non-mongoloid tribes will be included in the broad category of the part-mongolized peoples. And since the Finnish and Iranian tribes tend to have lower proportions of group B than the descendants of the actual invaders, it is clear that in so grouping them, we are being more than fair, and that the results are for that reason all the more convincing.

TABLE 2

Comparison of the ranges of values of q in the 2nd and 3d Categories

CATEGORY	NUMBER OF SAMPLES	UNDER .200	.200-.249	.250-.299	.300+	PER-CENT OVER .200	PER-CENT OVER .250	PER-CENT OVER .300
II. Non-European tribes of the U.S.S.R.	84	18	34	29	3	78.6	(38.4)	(3.5)
III. European Russians	145	124	19	2	..	14.5	(1.4)	.....

When the 84 non-European and the 145 European series are compared with regard to their values of q, it is elicited by actual count that in the former (2nd Category), the value of q attains or exceeds .200 in 66 of the 84 samples, or in 78.6 per cent of the total number. Among the European Russians (3d Category), $q = .200$ or more in only 21 of the 145 series, or in 14.5 per cent (Table 2).

Among the part-Mongols, 38.4 per cent of the total number reach or exceed .250, while only two European Russian samples (1.4 per cent) are within this range. Three of the non-European series are over the .300 mark (in addition to the Buriat and Kalmuck check samples), while none of the European Russians even reaches .300. Thus it is clear that even with the inclusion of the fundamentally non-mongoloid Finns and Iranians having lesser amounts of B, the non-European peoples of the U.S.S.R. possess the B factor in proportions vastly in excess of those Europeans who are living in the closest contact with them at the present time.

Some comment is due regarding the fact that three samples in the part-mongol 2nd Category exhibit *q* values which are actually higher than those of the Buriat and Kalmuck check samples (Fig. 1). Two of the three samples are small enough that the anomaly may be ascribed to sampling, since one of them consists of 66 Uzbeks, and the other of 53 Tajiks. The third sample comprises 150 Cheremiss, and while this is still a small series compared to the Buriat sample of 1260, nevertheless it is worthy of somewhat more consideration than the other two.

The possibility that the brachycephalic mongols may once have had even higher proportions of B than they now possess has already been discussed (v.s.). Since the Cheremiss are described as the most strongly mongolized of the Russian Finns (v.i.), it may be possible that a *q* value of .391 represents a freak survival of the old Mongol frequencies. It is also possible, of course, that the series is composed of several closely related families high in B, and to that extent, a sampling error may have occurred. In any case, the comparisons shown in Table 2 are evidence of the complete fulfillment of the 2nd and 3d requirements.

Additional observations may be made regarding the peoples of the contact zone from an inspection of Table 3. Here it is to be noted that there are some significant differences among the European Russians. The Ukrainians have much more B than the White Russians, as might be expected from the former's having mixed with the Turks and Tatars within recent times. The White Russians are found in the .100-.149 column, as are also the three series of Lithuanians listed by Boyd (*loc. cit.*). This fits with Coon's statement that there is a close resemblance between the two, if not indeed, identity (Coon, *loc. cit.*, p. 568). The highest proportions of B are found in those European Russians who live in Asiatic Russia, in the closest proximity to the non-European peoples, as in Perm and Ksyl-Orda, although some of the Moscow series are high in B.

Poland resembles the 'Hungarians' and the Ukrainians in the distributions of the *q* values. This is in correspondence with expectations arising out of the historical considerations. In Hungary, the highest *q* values are found in the Magyars; here again there is correspondence with the ethno-historical considerations, since the Magyars are the

TABLE 3

Values of q in countries in or near the contact zone (3d category)

COUNTRY	.000-.049	.050-.099	.100-.149	.150-.199	.200-.249	.250-.299	.300-.399
Russia, 145 series							
White Russians, 3	....	....	(3)	....	....	....	....
Ukrainians, 13	....	....	30.8%(4)	61.5%(8)	7.7%(1)	....	....
Great Russians, 2	....	....	....	(2)	....	....	....
'Russians' in European and Asiatic Russia, 127 series	....	....	17.3%(22)	66.8%(85)	14.2%(18)	1.6%(2)	....
Hungary, 25 series							
Magyars, 7	....	....	....	57.1%(4)	42.9%(3)	....	....
Debreczen, 3	....	....	(1)	(1)	(1)	....	....
'Hungarians', 6	....	....	33.3%(2)	66.7%(4)	....	....	....
Budapest, 4	....	....	75.0%(3)	25.0%(1)	....	....	....
Others, 5	....	....	60.0%(3)	40.0%(2)	....	....	....
Poland, 20 series	....	....	35.0%(7)	65.0%(13)	....	....	....
Yugoslavia, 22 series							
Serbs, 7	....	....	42.9%(3)	57.1%(4)	....	....	....
Ruthenians, 1	....	....	....	(1)	....	....	....
Schokatzen, 2	....	....	(1)	(1)	....	....	....
Slovaks, 1	....	....	(1)	....	....	....	....
Unspecified, 11	....	18.2%(2)	63.6%(7)	9.1%(1)	9.1%(1)	....	....
Finland, 64 series	....	....	67.2%(43)	31.2%(20)	1.6%(1)	....	....
Roumania, 15 series							
Sséklers (Hungarian), 3	....	....	(2)	(1)	....	....	....
'Roumanians', 12	....	....	91.7%(11)	8.3%(1)	....	....	....
Bulgaria, 6 series	....	....	(6)	....	....	....	....
Czechoslovakia, 10 series							
Ruthenians, 1	....	....	....	(1)	....	....	....
Slovaks, 2	....	....	(2)	....	....	....	....
Czechs, 3	....	(2)	(1)	....	....	....	....
Unspecified, 4	....	....	(4)	....	....	....	....

lineal descendants of the Turkified invaders of the 9th century, and some of them even claim descent from mongoloids (v.i.).

The Finns in Finland have somewhat less B than the Hungarians, to whom they are related by language ties, and less than the Finnish tribes in Asiatic Russia. Bulgaria's place in the table is surprising at first glance; however, the low proportions of B in Bulgaria are explained by the historical facts. The ancient Bolgars who settled that country were Turkified Finns, and in any case their numbers were not great. Several of the Slavic series exhibit very little B. This is particularly true in Yugoslavia and Czechoslovakia. Of the three Czech samples, for example, two contain q values under .100, while the third is under .150.

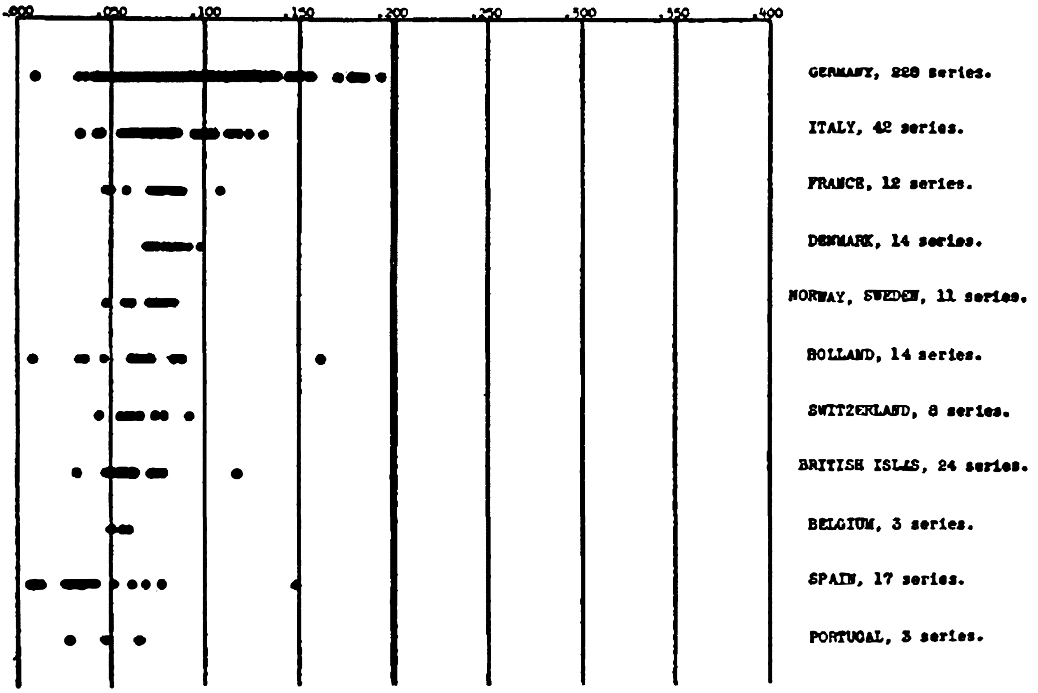

FIG. 2. THE VALUES OF q IN THE POPULATIONS OF CATEGORY IV

Requirement No. 4 (populations geographically remote). Little time need be expended in demonstrating that the further one proceeds westward from the zone of invasion, the smaller become the amounts of group B in the respective populations. Fig. 2 represents the actual q values of most of the countries in the 4th Category; those countries which have been omitted fall into the range of values of the category as a whole (see Fig. 1). It is evident at a glance that the *q* values diminish as the distance from the contact zone increases, and that the entries tend to become more and more concentrated in the columns for the lower values of *q*. The lowest proportions of group B are found in Spain and Portugal, where 12 of the 20 series contain *q* values of less than .050.

The striking difference between the sample from Valladolid and the 16 other Spanish series has been remarked by Haldane ('41). Its *q* value of .149 is higher than those found in any population of the 4th Category except Germany, and one of the Dutch series. Valladolid was the meeting place of the cortes of Castile between the 11th and the 16th centuries, and its university dates from about 1250 A.D. (*Encyclopaedia Britannica*, '37). It is doubtful, however, that the unexpectedly high value of *q* can be related to these cosmopolitan features in the past history of Valladolid, since Haldane states that the material consists of soldiers and students drawn from a large part of central Spain. At the same time, it is probably unsafe to accept Haldane's *a priori* conclusion that the findings may have resulted from serious errors in technique, since further researches may eventually reveal some other explanation.[7] At any rate, the Valladolid series cannot be said to disturb the established trend to any great extent.

In his book, *The Races of Europe*, Coon presents the evidence for his belief that in some of the northern parts of Europe there is a survival or a re-emergence of Upper Paleolithic man. The ethnic types most representative of such survivals or re-emergences are found in Iceland, western Ireland, the coast of Holland, northern Germany, Belgium, and in some parts of Scandinavia. The Lapps are also related to Upper Paleolithic horizons.

It is at once evident that group B is very scanty in all these populations. Only in the Lapps (and in a single Dutch series) does the *q* value ever attain or exceed the .100 mark. Even in the Lapps,

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[7] The following reference may indicate the direction of such an explanation: 500 Spanish Jews had these blood group frequencies: O: 38.8 percent, A: 33.0 percent, B: 23.2 percent, AB: 5.0 percent (Hirszfeld and Hirszfeld, '19). The *q* value in this series is .165, comparable to other Sephardic Jews. If it be possible that the 'students and soldiers' of Valladolid may have included a large submerged Jewish element, then the mystery is solved. The migration of Sephardic Jews to Holland in the 16th century may be related to the presence of one exceptionally high *q* value in that country also.

8 of their 12 series contain values under .100, and four of these are under .050. Thus it seems fair to assume that Paleolithic man in Europe could have contributed very little, if any B.

In fact, if there is anything at all characteristic in the serology of the peoples in the areas designated, it is not in the proportions of B, which do not differ significantly from the rest of western Europe; it is rather in the remarkably high proportions of group O which are present in the more peripheral and the more unmixed among them. Thus, the Icelandic series of 800 persons has the extremely high *r* value of .747. The *r* value of Boyd's Irish series is .744; that of Sachs ('41) is .732, and that of Taylor's is .765. Values of *r* in excess of .700 are also found in many of the series of the other peoples in these areas.

As for the Nordic and Mediterranean 'races', it is equally unlikely that their ancestors could have contributed any B to the European blood group picture. Scandinavia, which is said to have been the breeding ground of the Nordics, and which still contains a large Nordic element, exhibits *q* values well under .100, as does also Denmark. Germany is well mixed serologically as well as ethnically; however, a great many of the German series have extremely low *q* values, and among these are the two series of 'Saxons' and the single sample of 'Angles'.

The Mediterranean race, insofar as it is represented in its greatest purity by the Spanish and the Portughese, has already been shown to have the lowest proportions of group B in Europe (Fig. 2). The Alpine division, represented by the French, is also low in B, since of the 12 French series known to me, only one reaches or exceeds the .100 mark (.109). However, whereas the Nordic and Mediterranean peoples frequently exhibit very high values of *p* (group A), there is no series in France with *p* values of .300 or over, except for those derived from Alsace, where German admixture may be assumed.

Thus even a casual survey of the distributions of the three blood group factors reveals the fact that the racial stocks of western Europe differ significantly in their relative proportions of groups O and A, but that all agree in having such small amounts of group B that its presence could be accounted for by diffusion, during the centuries which have elapsed since the Asiatic invasions of eastern Europe first introduced the B factor.

Requirement No. 5 (isolated refugee populations, lowest in B). This requirement is somewhat more difficult of fulfillment, since no sizeable population in the contact zone can be said to have escaped completely from the invaders during the ten centuries of expansion. However, the isolated tribes of the Caucasus mountain ranges constitute a close approach to the ideal refugee population which we seek, and as a matter of fact, the manner of their deviation from the desired purity may even prove illuminating.

There is historical as well as anthropological evidence that their escape was not complete. The former has to do with the periodic incursions into the Caucasus of each of the invading armies, resulting in the flight of the invaded peoples further and further into the mountain fastnesses and the intervening valleys. The present distribution of this refuge area is very restricted; it consists of a narrow strip extending horizontally eastward from the toe of the Black Sea. South of it reside the Armenians and the Turks, while to the north are found Russians on the left, and the Kirghiz Turko-Mongols on the right. A large remnant of true Mongols, represented by the Kalmucks of the 1st Category, is found north of the Kirghiz (Coon, *loc. cit.,* p. 631).

Coon's map of racial distributions indicates that the Caucasic-speaking inhabitants of the refuge area include several pure Mediterranean varieties, as well as some Alpine-Danubian mixtures. Distinct from these, however, are the Ossetes, who are Iranians, and who are believed to be the result of the mixture of Scytho-Sarmatian refugees from the north with the indigenous peoples (Coon, *loc. cit.,* p. 632). The Ossetes are described as possessing many Nordic and Noric characters, and are to be referred historically to the Scythian Alans (*idem,* p. 197).

However, in some of the groups within this area there are strong traces of mongolization, attributable to the Asiatic inroads. The Lesghians, for example, range from frankly mongoloid types at one extreme, to pure whites at the other. It is also to be noted that one of the Lesghian tribes calls itself "Avars" (*Encyclopaedia Britannica,* '37a).

Semenskaya divides the Caucasian tribes into three classes: 1. Eastern; 2. Metamorphosed; 3. Western (Boyd, *loc. cit.*). It is significant that the Ossetes, who are in many respects closest to the Nordic physical type, are included with the Lesghians in the 'Metamor-

TABLE 4

Values of q in the refugee populations of the Caucasus (5th Category)

NAME	NUMBER OF SERIES	.000-.049	.050-.099	.100-.149	.150-.199	.200-.249	.250-.299	.300-.349
Eastern Group								
Kakhetintsi	2	..	..	*	*	..	..	..
Tushini	1	..	..	*	..	..	..	..
Kartalintsi	3	..	**	*	..	..	..	..
Mokhevtsi	1	..	*	..	..	..	..	..
"Metamorphosed" group								
Lesghians	1	..	..	*	..	..	..	..
Ossetes	4	*	..	***	..	..	..	..
Western Group								
Rachintsi	1	..	*	..	..	..	..	..
Guritsi	3	*	**	..	..	..	..	..
Imeritini	3	*	**	..	..	..	..	..
Mingreltsi	3	*	**	..	..	..	..	..
Swanetes	2	*	*	..	..	..	..	..
Adhartsi	1	*	..	..	..	..	..	..

phosed' class. Correspondingly, four of the five series in this class contain *q* values in excess of .100. The Eastern Caucasic tribes include three samples which are under .100, as well as one which exceeds .150. However, it is important to note that not one of the 25 series in Semenskaya's three classes contains a *q* value as high as .200 (Table 4).

Three other series are listed from the Caucasus region; one consists of Turks, who are considered together with other Turks (v.i.), while two samples of Ingushetes exhibit values in the .100-.149 column.

The Western group of tribes is of the greatest interest in connection with the present argument. It contains 13 series, totalling over 10,000 persons. In none of the samples does the *q* value reach even .100; in five samples the value is less than .050, and in one small series of Mingreltsi, AB was found, but no individuals of group B. These findings are all the more striking when it is remembered that in their almost complete lack of the B factor, they are rivalled only by the Basques, and that while the latter are distant by an entire continent from the scene of invasion, these Caucasian tribes are practically within the contact zone.

Thus, insofar as the Western Caucasic peoples may be accepted to be representative of a relatively pure refugee population, there seems to be sufficient evidence that these early inhabitants of the contact zone were lacking in B anterior to the arrival of the Asiatic armies; that such small amounts of B as they now possess may be ascribed to mongoloid or Turko-Tatar admixture, and that for them, at least, the 5th requirement is fulfilled.

NON-EUROPEAN POPULATIONS OF THE U.S.S.R.

Now that the requirements which were set up in connection with the five broad categories of populations have been considered, and, it is thought, fulfilled, it may be of interest to investigate one of them more fully. Since the 2nd Category consists of a heterogeneous assortment of peoples of widely divergent origins, it should be possible to apply the same criteria to its component tribes, and to demonstrate in them a correlation between the degree of mongolization and the respective proportions of group B.[8]

It is most gratifying to find that such a correlation is plainly discernible. This is in spite of the fact that the data is somewhat defective as to some of the elements of each of the sub-categories. There are no data available, for example, regarding the blood group frequencies in the Yenesseian Ostyaks, Chukchi, Yukaghir, etc., nor in the Finnish Voguls and Ostiaks who migrated to the Ob region, nor in the mongoloid Samoyedes, who represent the Buriat-Mongols on European soil. Further, none of the data can be said to have been collected with a view to making a systematic correlation possible.

The non-European populations of the U.S.S.R. may be classified under three main headings (apart from the true mongoloids of the 1st Category, and the Caucasic tribes of the 5th): 1. Iranians; 2. Finns; 3. Turko-Tatars. All of them have been subjected to some mongolization, varying in degree from relatively little in the Iranians and some Finns, to such a high degree in some of the Turko-Tatar tribes that the appellation "Turko-Mongol" becomes more appropriate. All of them possess significantly large amounts of group B, so that the term, "low in B", as applied to members of the 2nd Category, must be recognized to have only a relative meaning.

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[8] It should be clear that there is no implication of a correlation between the physical traits of an *individual* and his blood group. There is no genetic justification for such a premise. The equation is between the tribal distributions of mongoloid traits and of the B factor.

The revelant values of *q* are shown in Table 5, in which the subcategories and the tribes within each of them are listed, roughly in the order of their *q* values. While space does not permit a completely documented discussion of each of the peoples listed therein, nevertheless it is possible to summarize a sufficient amount of the data given by Coon (*loc. cit.*) to establish the presence of a considerable degree of correlation.

The Iranian Ossetes (of the 5th Category, included here for the sake of completeness) are described as Scytho-Sarmatians from the

TABLE 5

Comparison of the range of values of q in the non-European populations of the U.S.S.R. (Category II)

NAME	NUMBER OF SAMPLES	UNDER .200	.200-.249	.250-.299	.300+
Iranians					
Ossetes[a]	4	****	....	....	....
Tajiks	6	****	*	....	*
Finns					
Zyrians	1	*	....	....	....
Carelians	1	*	....	....	....
Votiak	10	****	*****	*	....
Permiaks	5	....	****	*	....
Cheremiss (Mari)	2	....	....	*	*
Turkified Finns					
Bashkir	1	*	....	....	....
Chuvash	5	....	**	***	....
Turko-Tatar-Mongols					
Tiurks	2	*	*	....	....
Kara-Kalpacks	1	....	*	....	....
Turkomans	1	....	*	....	....
Kazaks	5	*	**	**	....
Tatars	7	....	*****	**	....
Uzbeks	7	*	***	**	*
Kipchaks	1	....	....	*	....
Kirghiz	12	....	**	***** *****	....

[a] From the 5th Category, included for comparison with the Tajiks.

northern plains. Although enough admixture is present to justify their inclusion in the "metamorphosed" class of Caucasian inhabitants, they exhibit fundamentally Nordic characteristics. The Ossetes are clearly the least mongolized of the ethnic groups under present discussion; correspondingly, all four of their blood-group samples have q values which are not only less than .200, but well under .150.

The Iranian Tajiks are described as typical Alpines, resembling Frenchmen and southern Germans; nevertheless, a small amount of mongoloid admixture is present in some of their tribal groups (Coon, *loc. cit.*, p. 638). Four of the six Tajik series exhibit q values under .200; it may be that the remaining two samples are associated with the greater degrees of mongolization in some areas. At any rate, as regards their position in the 2nd Category, the Tajiks must be classed as 'non-mongoloids, low in B'.

The Finns present a more complex problem, in that there are wide geographical variations, but only small physical differences among them. To a considerable extent, however, these physical variations will be found to correspond to the variations in the values of the B-gene. Thus, the Carelians are said to be representative of the Iron Age Nordic physical type, and to include only a lesser mongoloid element (Coon, *loc. cit.*, p. 344). The physical characteristics of the Zyrians appear to correspond closely to those of the Carelians (*idem*, pp. 342 and 349), and it is significant that the single series of Carelians and of Zyrians both exhibit q values which are less than .200.

The Votiaks are represented by ten series, of which four contain values under .200. Five samples exhibit values between .200 and .249, while the tenth series lies between .250 and .299. Coon (p. 348) describes an appreciable amount of rufosity, and believes the Votiaks to be not appreciably more mongoloid than the Mordvins and Cheremiss (however, see below). Nevertheless, from their deficiency of body hair, and the predominance of straight head hair and darker pigmentation, it seems fair to infer that the Votiaks must at least be more mongoloid than the Nordic Carelians.

The Permiaks resemble the Votiaks in their physical characteristics, lacking, however, the latter's rufosity. Of the five Permiak samples, four are found in the .200-.249 column, and the fifth between .250 and .299. Thus the Permiaks possess more B than the foregoing tribes, but apart from the difference in hair color, there are no ethnic or historical data which might permit a clear interpretation.

The Cheremiss, on the other hand, are described as having been recognizably affected by Mongol and Tatar infiltration. This is evidenced by very high frequencies of the median eye fold, dark pigmentation, weak beard growth, and concavity of the nasal profile (*idem*, p. 347). These are clearly the most highly mongolized of all the Finns of the U.S.S.R.; concomitantly, they possess the highest proportions of group B, with q values in the .250-.299 and the .300+ columns.

Thus it is apparent that within the limits of the published serological and anthropological data, the proportions of group B in the Finns increase apace with the evidences of mongolization. A perfect correlation is not possible, since there are many gaps and imperfections in the data. In addition to the deficiencies already listed, it would be of interest to know the blood groups of the "Forest" Cheremiss, who are non-mongoloid, and are said to be closest to the Carelian Nordic type (p. 347). Among the mixed and variable Votiaks, it would be advantageous to segregate the blood-group data with an eye to the varying degrees of mongolization. However, even within the limits of the available information, it appears that in the Finns, who are characterized by Coon as ". . . . all very much alike", the relatively minor differences which exist are clearly reflected in the gene values for group B.

The Turkicized Finns are represented in the blood-group tables by the Bashkir and the Chuvash. These two tribes illustrate clearly the difference between turkicization and mongolization. The Bashkir, in spite of their dark pigmentation, exhibit (Turk-like) convex noses in 15 per cent of their number, but no mongoloid nasal form (*idem*, p. 579). Their blood group distributions, as represented by a single series, contain a relatively low q value, just under .200. Thus the Bashkir are seen to be actually less mongoloid, both as to physical type and as to serology, than the Cheremiss, who are classified as Finns.

The Chuvash, on the other hand, although very variable, exhibit definite mongoloid traits as a result of Tatar admixture (*idem*, p. 578). The mongoloid characters are accompanied by correspondingly larger amounts of group B, since two of their five series are to be found in the column $q = .200\text{-}.249$, and the remaining three in the column $q = .250\text{-}.299$. These differences between the two varieties of Turkicized Finns constitute impressive evidence that the Asiatic "Turks" who accompanied the Mongols were themselves very variable in their respective degrees of mongolization, and concomitantly, in their proportions of group B.

The partially mongolized peoples variously known as Asiatic Turks, Tatars and Turko-Mongols constitute the most difficult problem of all. This is not surprising, in view of the complexity and the long duration of the mixing process which occurred before, during, and after the ten centuries of periodic expansion. This mixing process involved the pre-historic white peoples of central Asia (some of them blonde), the pre-historic and the historic central Asiatic Turks, and at least two distinct varieties of pure mongoloids. One of these appears to have had very high proportions of group B, while the other had very little, or perhaps, in the beginning, even none.

In spite of this complexity, and of the uneven value of the blood-group data, a certain degree of parallelism can be demonstrated. Thus, the Azerbajian Turks of the Caucasus and the Turkomans are described as almost pure whites. However, some mongoloid traits are present in both, and these are more strongly marked in the Turkomans (Coon, *loc. cit.,* p. 424). Their blood groups, insofar as they are represented by the published data, agree with this characterization, since the Turks of the Caucasus have a q value of only .163, while that of the Turkomans is .208. The single series of Turks from Andizhan may reasonably be thought, from its geographical position, to have had more opportunity to absorb Asiatic blood; at any rate, its q value is somewhat higher (.225). The Kazaks are spread over three columns, while the related Kara-Kalpacks, represented by one small series, is found a little below the mean of the Kazak values.

The Uzbeks furnish a measure of correlation, manifested, however, in their marked variability. In their physical characteristics, they are said to run the gamut from pure white, or almost pure white individuals, to others who are apparently pure mongoloids (Coon, *loc. cit.,* p. 635). The more mongoloid of the Uzbeks are chiefly those in the clan divisions, while those outside the clans are more frequently European in habitus (Vishnevsky, '36). Their blood groups also cover the entire range of variability, since the seven Uzbek samples contain values in all four columns, corresponding to the Iranian frequencies at one extreme, and the Kalmuck and Buriat frequencies at the other. Here, as in the instance of the Votiak Finns, it would be more satisfying to have the blood-group data divided with regard to the local physical differences within the Uzbek tribes.

Under the generic name of "Tatars" are included several widely differing groups of tribes; however, both the Tatars and the Kirghiz are listed as "Turko-Mongols", and are unquestionably the most strongly mongolized of all the mixed populations under present discussion. The Kipchaks are more or less pure mongoloids of the later invasions, being associated with the period following Genghis Khan. As expected, the Kipchaks, Tatars and Kirghiz all have large amounts of B, the most consistently high values being present in the Kirghiz (Table 5).

In summary, not only does the 2nd Category as a whole illustrate the close relationship between the extent of mongoloid admixture and the frequency of the B factor, but also its sub-categories, and even the individual tribes within the sub-categories all lend support to that major premise. It is important to note, however, that regardless of their proportions of B, brachycephaly is the rule in this category of populations. Furthermore, if the skeletal material is to be credited, these tribes have always been brachycephalic (v.s.). It is highly probable that in providing eastern Europe with its group B, these mixed Asiatic-white invaders must also have contributed an even greater increment to its brachycephaly. Consequently, it is not surprising that the white populations now living in this area should in their turn be more uniform in their head shape than in their proportions of the B factor.

DISCUSSION

As far as we have gone, it has been possible to demonstrate that the larger amounts of group B are found in the brachycephalic mongols, and, in progressively diminishing amounts, in their partly mongolized allies, and in the European peoples of the contact zone. This would seem to establish the *source* of group B, but something more is needed if we are to decide the *time* of its introduction into Europe.

It may be superfluous to point out that the acceptance of the proposed derivation of group B from brachycephalic mongoloids carries no implications as to the presence or absence of a significantly large mongoloid element in the ancestry of a group B European. The A and B factors are inherited as Mendelian dominants, and are not known to be linked genetically to any physical or physiological character; consequently, decisions as to racial origins cannot be predicated upon the blood groups alone, but must be traced with the concurrent assistance of all the disciplines.

The peoples of the contact zone are not appreciably mongoloid, in spite of historical evidences of actual intermarriage over a period of several centuries. Russia exhibits the strongest traces of mongolization, while in Hungary, the recognizably mongoloid traits are present in only 5 per cent of the population, and are found chiefly in the rural Magyars. Some of these trace their ancestry to the Avars themselves, rather than to the armies of Árpad. However, in 20 per cent, and chiefly in the nobility, Turkish blood is said to be in evidence (Coon, *loc. cit.,* pp. 584, 586).

Conversely, the absence of group B in an individual does not in itself rule out even a strongly mongolized ancestry, since even in the Buriats and Kalmucks, only about 50 per cent belong to groups B and AB, and only that proportion could transmit the B factor to their offspring. The tribes of the 2nd Category have in general lesser amounts, even in the more strongly mongolized groups.

Since the presence of group B in an individual does not in itself imply a significant degree of mongolization, and its absence does not exclude it, what, then, is the significance of the correlations which have been demonstrated in the Siberian tribes? The answer to this question lies in the difference between the mechanisms by which the two sets of characters are inherited. It is obvious that if the B factor and the 'mongoloid' physical status were completely linked genetically, then, generally speaking, every B individual would be a mongoloid. Even in the absence of linkage, if each of the two characters were transmitted by a single gene, then we should expect to find recognizable mongoloid types in all parts of Europe. This, however, is not the case.

The 'mongoloid' habitus is not a single character; it is made up of a complex of physical traits. It is only when an appreciable number of these traits are combined in one individual that a 'mongoloid' emerges as a physical type. This complex of traits is not inherited *in toto,* as a unit character, but is dependent upon the collective action of a large number of genes. Following the introduction of these genes into a new population, the process of independent assortment would gradually but inevitably effect the disappearance of the mongoloid habitus in the subsequent generations. If, however, the increment of mongoloid admixture were very large, or, alternatively, if the continued influx of newcomers were to permit a significant amount of crossing back to the mongoloid stock, then a recognizable mongoloid element could be expected to persist in the invaded population.[10]

In the instance of the blood group factors (including the M-N and the Rh complexes), the mechanism is entirely different. These factors are transmitted as unit characters, by single genes. If they appear at all in the offspring, they appear *in toto,* and are so transmitted to subsequent generations. Therefore, it is theoretically possible for an individual of group B to have had only one Asiatic ancestor in the past fourteen centuries, and if that ancestor was a mongol-white cross, then the ultimate pure mongoloid source of his B factor could be much older.

It is considerations such as these which have prompted Shanklin ('36) to remark, in another connection, that "the serology was much more susceptible to foreign influence than the somatology of the group". In consequence, it is only natural that even the European populations in the contact zone should show only occasional traces of mongolization, and those more distant, none at all.

The tribes of the 2nd Category constitute the crux of this argument. The fact that they exhibit recognizable mongoloid traits in some of their groups, and the fact that the presence of these traits is rather closely correlated with the higher proportions of group B must be explainable by the combined effect of two considerations. The first of these is the fact that they absorbed much larger increments of mongoloid blood from their Mongol allies and overlords than they were able to pass on to the peoples of Europe. The second consideration has to do with the relatively short time which has elapsed since they mixed with the mongols in Asia and along the line of march. For it is obvious that in peoples who have absorbed a large increment of foreign blood, a longer period of time will be required to assimilate and digest the serological and somatological differences, than in those in whom the increment was smaller.

This is all the more true in the present instance, in which the new (mongoloid) traits appear to be to some extent genetically dominant (Tao, '35). Presumably the period of time which has elapsed since the era of the mongoloid invasions has sufficed to obliterate such correlations as may once have existed in Hungarians, Poles and Russians;

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[10] It is assumed that the Tatars and the Turko-Mongols must have retained their strongly mongoloid characters by virtue of their long association with the Mongols on the central Asiatic plains, and along the path of conquest.

certainly it has not sufficed in the instance of the mongol-white mixtures of the U.S.S.R. It is the continued existence of these correlations which points not only to the source of Europe's group B, but also to the time of its introduction.

As for the European peoples of the contact zone, the serological picture has been rendered less self-evident by the events which have transpired since the end of the Asiatic invasions. When full account is taken of these historical factors, the proportions of group B in eastern Europe become more intelligible. And if the amounts of B in some of these populations do not appear as large as might at first be anticipated, it must be recalled that with the eastward Slavic push in the 16th and succeding centuries, many of the mongoloid and mongolized elements were forced out of Europe, leaving only scattered settlements behind. The subsequent alternating Germanic and Slavic expansions have served to soften, and often to obliterate the lines of serological demarcation between the invaded parts of Europe and those further west. The same period of time has sufficed to spread the B factor westward in progressively diminishing proportions, reaching a low ebb in Spain and Portugal. However, at the zone of contact between the European and the Asiatic peoples, the history of group B is clearly written.

SUMMARY

Although it is generally conceded that the European populations obtained their group B from Asia, there appear to be no indications in the literature as to the time of its arrival, nor as to the identity of the peoples who brought it. In an attempt to decide these questions, the historical and ethnical data regarding five categories of populations have been correlated with their respective proportions of group B.

The categories are the following: I. The modern representatives and descendants of the pure mongoloid invaders of the 5th, 6th and 13th centuries; II. The descendants of the mixed Turko-Tatar-Mongols who accompanied the Mongols, and who chiefly affected the actual occupation of the invaded areas; III. The Europeans now living in closest contact with the peoples of the first two categories, and who were most affected by the invasions; IV. The Europeans who are geographically remote from the zone of contact; V. The isolated descendants of the refugees from the Asiatic invaders.

These comparisons demonstrate that the brachycephalic element among the mongoloids of the 1st Category possess the highest proportions of group B of any of the populations of the continent of Asia, and that the proportions of B are progressively smaller in each of the succeeding categories, regardless of geographical location. Further, some of the smaller subgroups, and even the individual tribes within those subgroups all exhibit a close relationship between the degree of mongolization and the amount of group B.

These findings appear to justify the conclusion that group B was brought into Europe by the brachycephalic Asiatic armies between the 5th and the 15th centuries, since if its introduction had been more ancient, such close correlations would not now be demonstrable.

The fact that the part-mongol elements of those armies, while possessing widely varying amounts of B, were nevertheless all brachycephalic, may serve to explain the lack of correlation between head form and blood groups in eastern Europe. The results of these studies illustrate the necessity of combining the historical and ethnical considerations with the analysis of the blood group data, rather than to attempt to interpret the latter from their purely geographical distributions.

ACKNOWLEDGMENT

The writer wishes to express his gratitude to Professor Carleton S. Coon, Doctor Alexander S. Wiener, and Professor William C. Boyd, for their kindness in reading this paper in manuscript, and for their numerous suggestions and corrections.

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